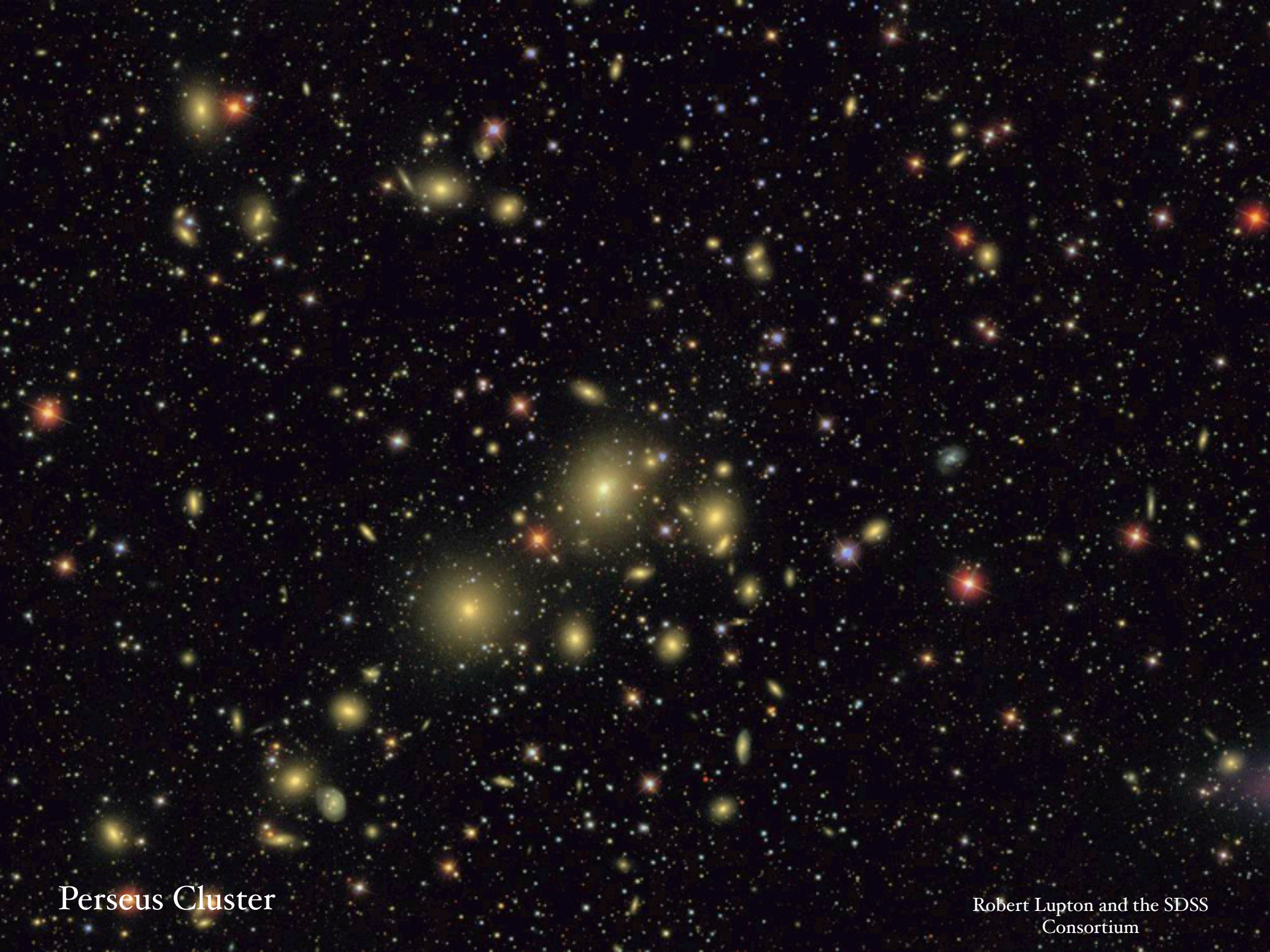
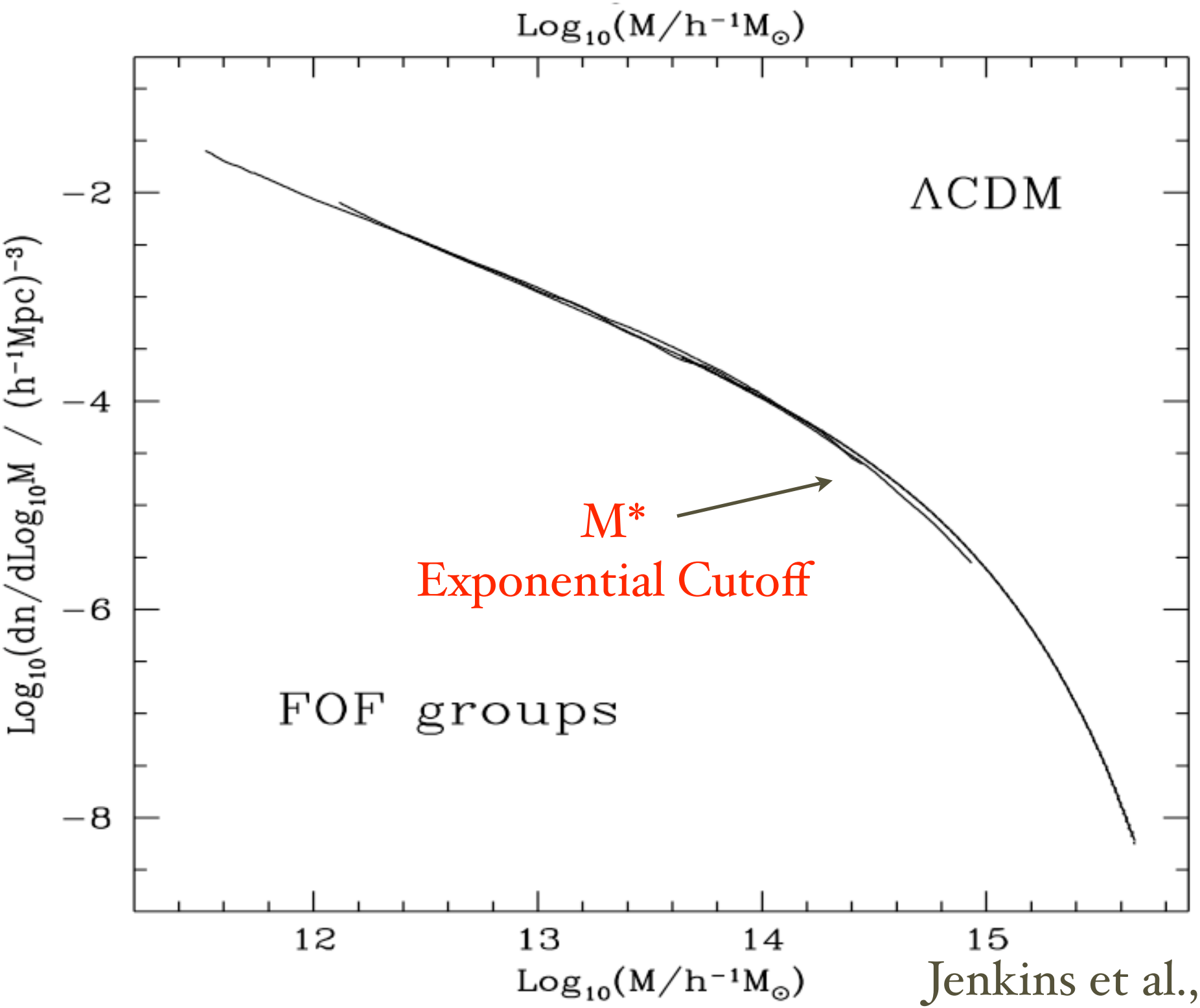
Cluster Mass Calibrations: 10% Measurements from Sloan

Erin Sheldon



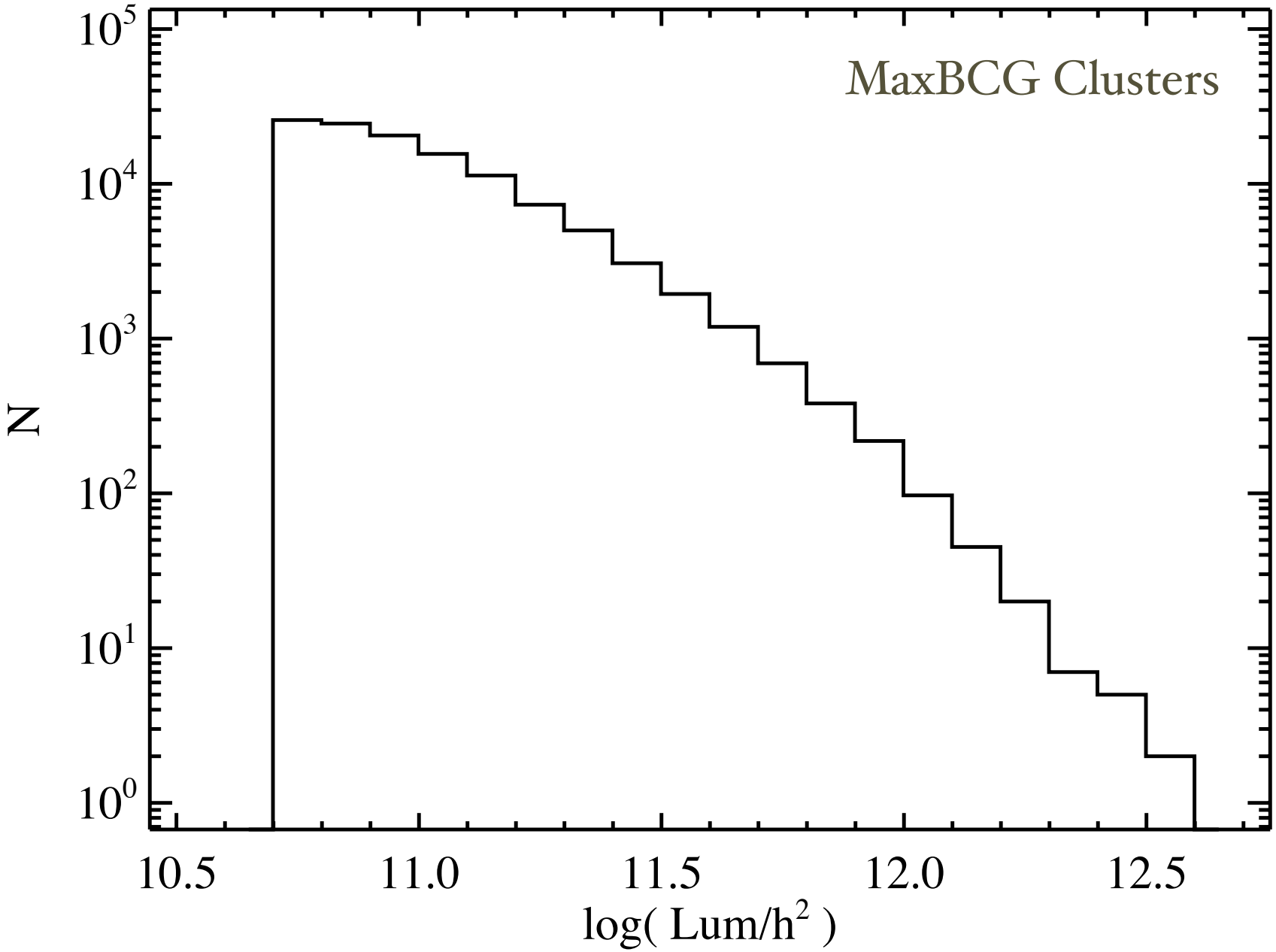
Perseus Cluster

Robert Lupton and the SDSS Consortium

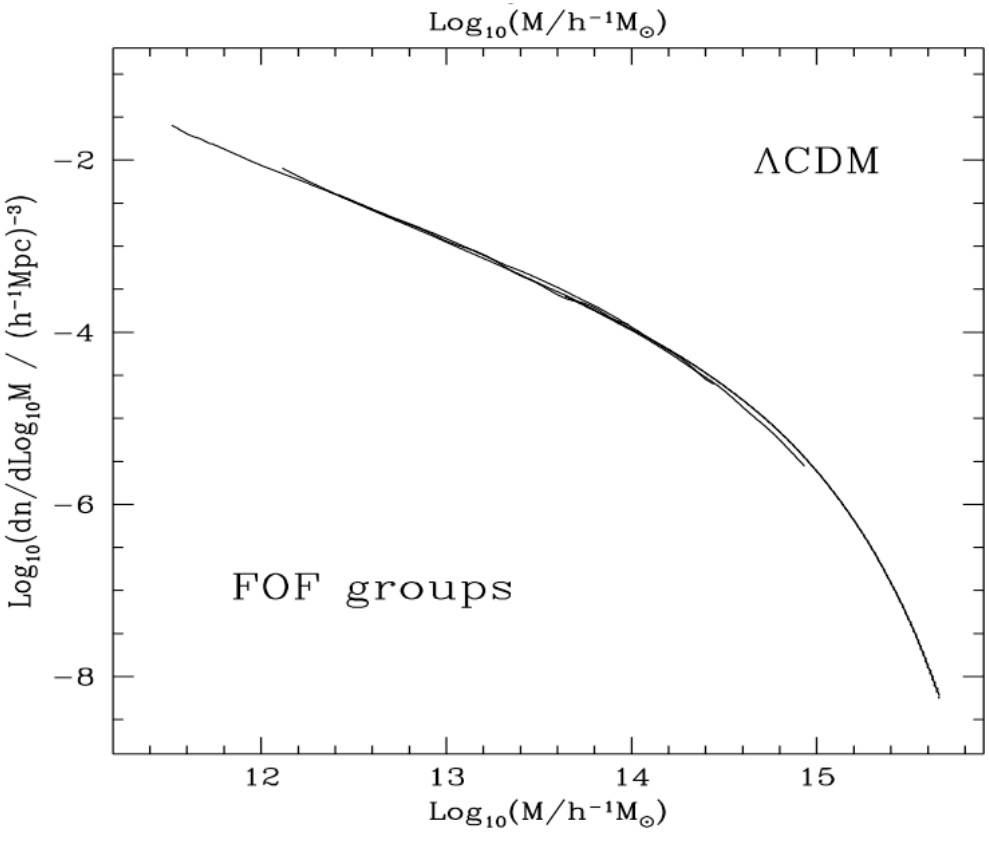


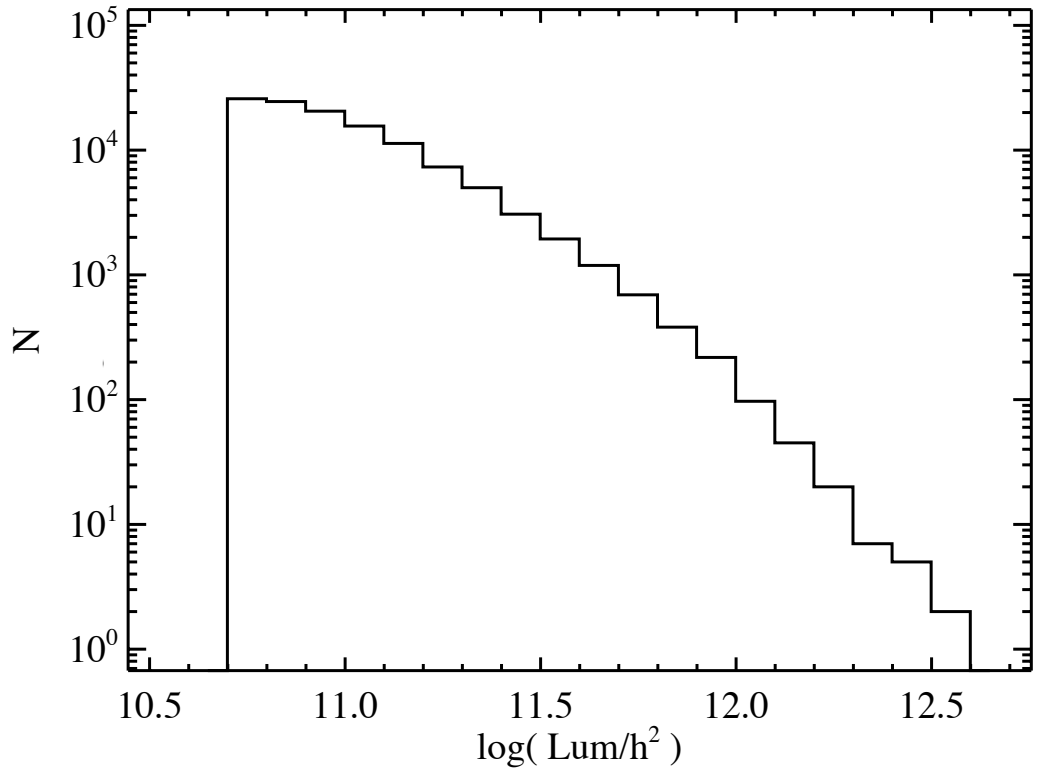
Jenkins et al., 2001

Luminosity Function of Clusters



Connect the Mass Function and Luminosity Function





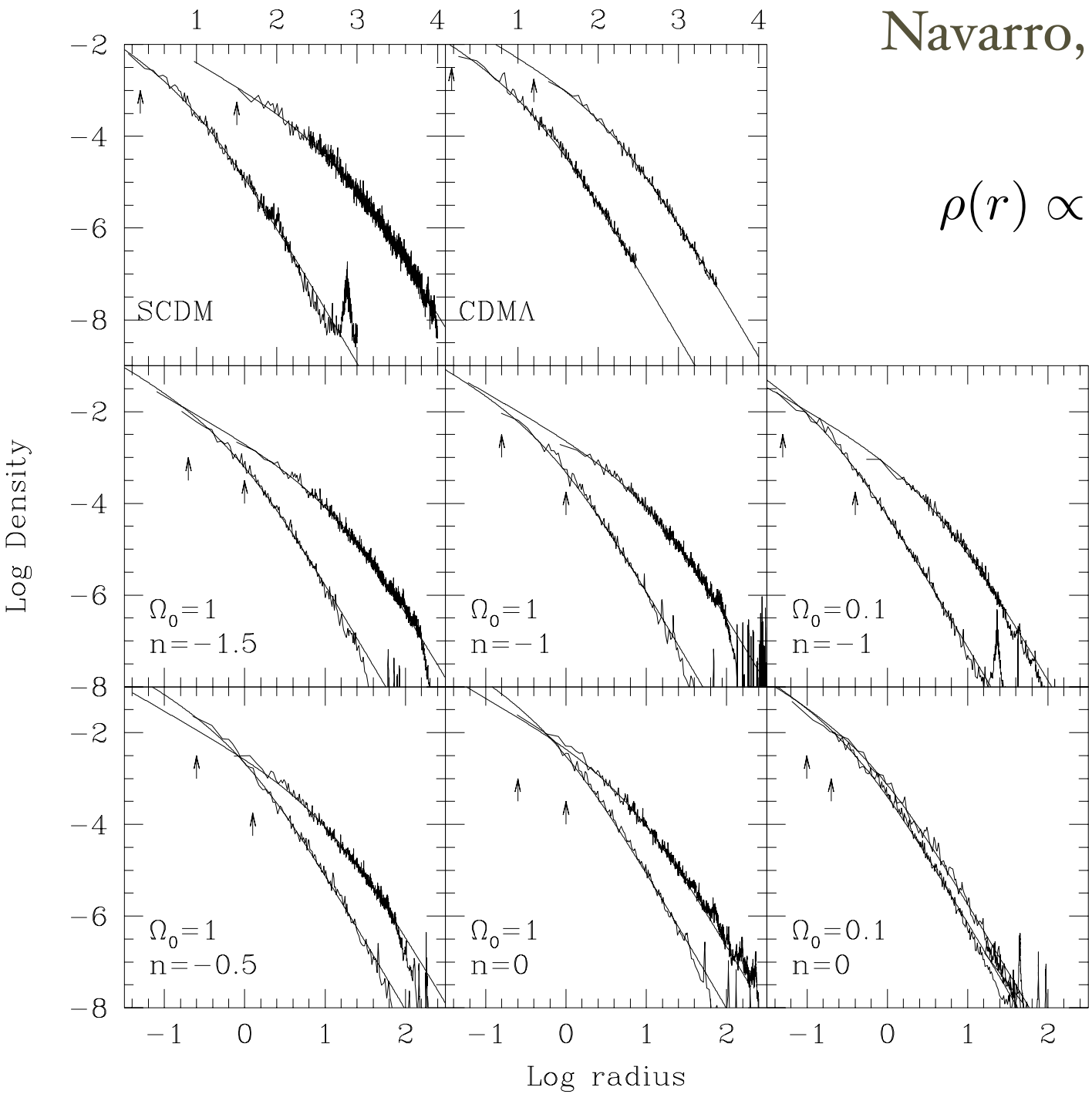
Weak Lensing Calibration

- Stack clusters as a function of observable
- Model-independent mass estimators (Johnston et al)
- Difficult to estimate scatter

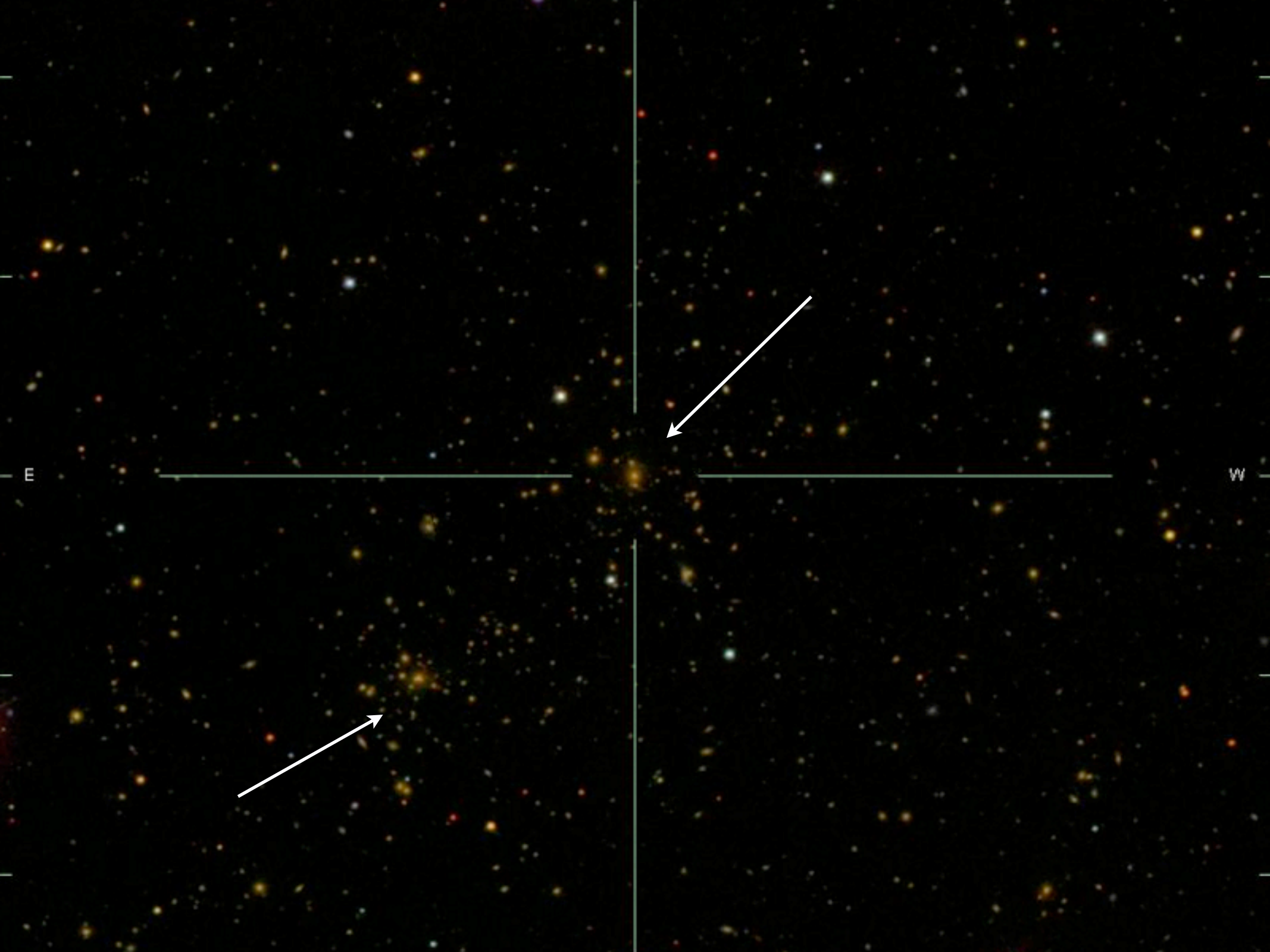
Universal Profile

Navarro, Frenk, White (NFW)

$$\rho(r) \propto \frac{1}{(r/r_s)(1+r/r_s)^2}$$

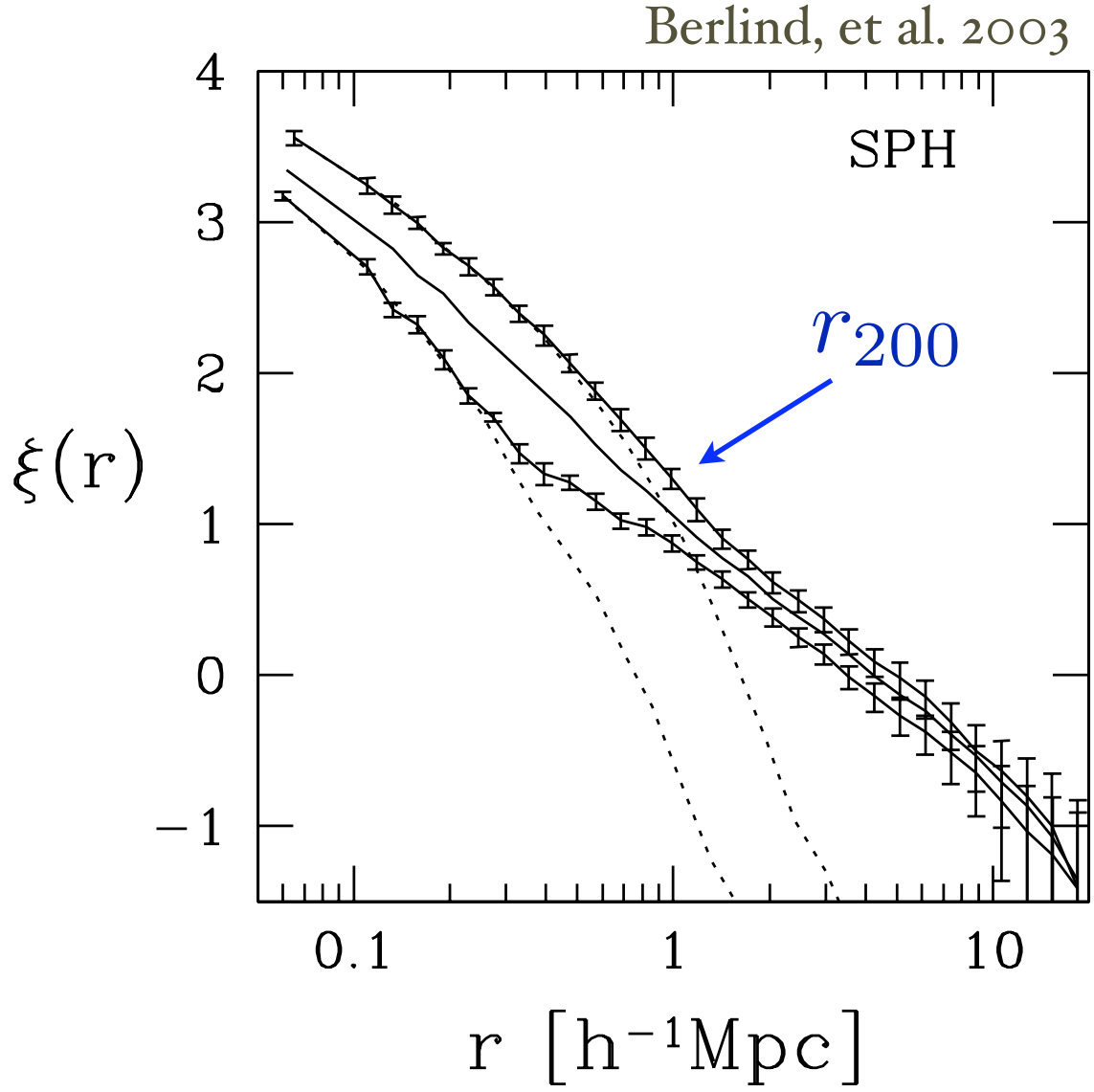


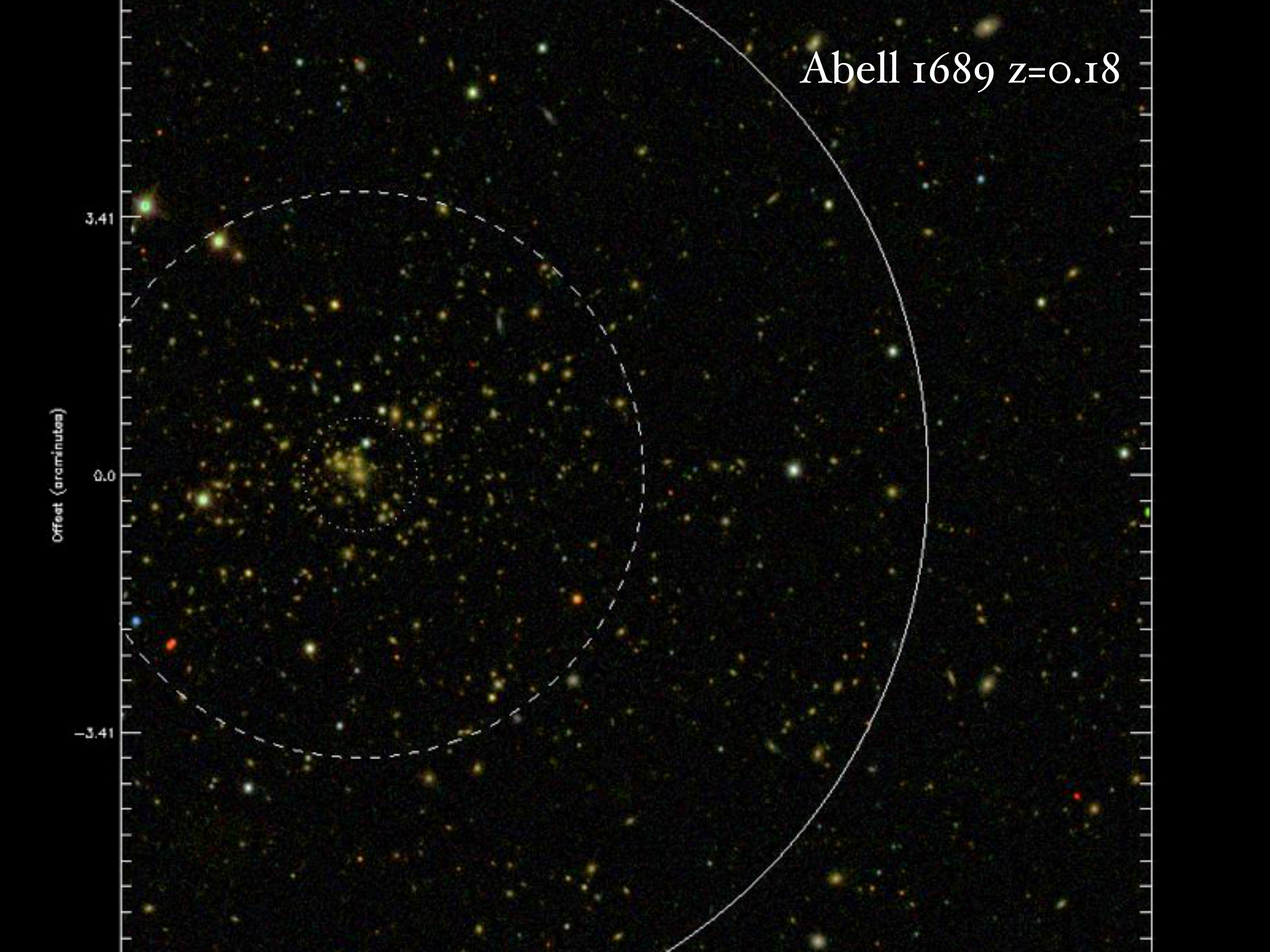
Navarro, Frenk, White
1997

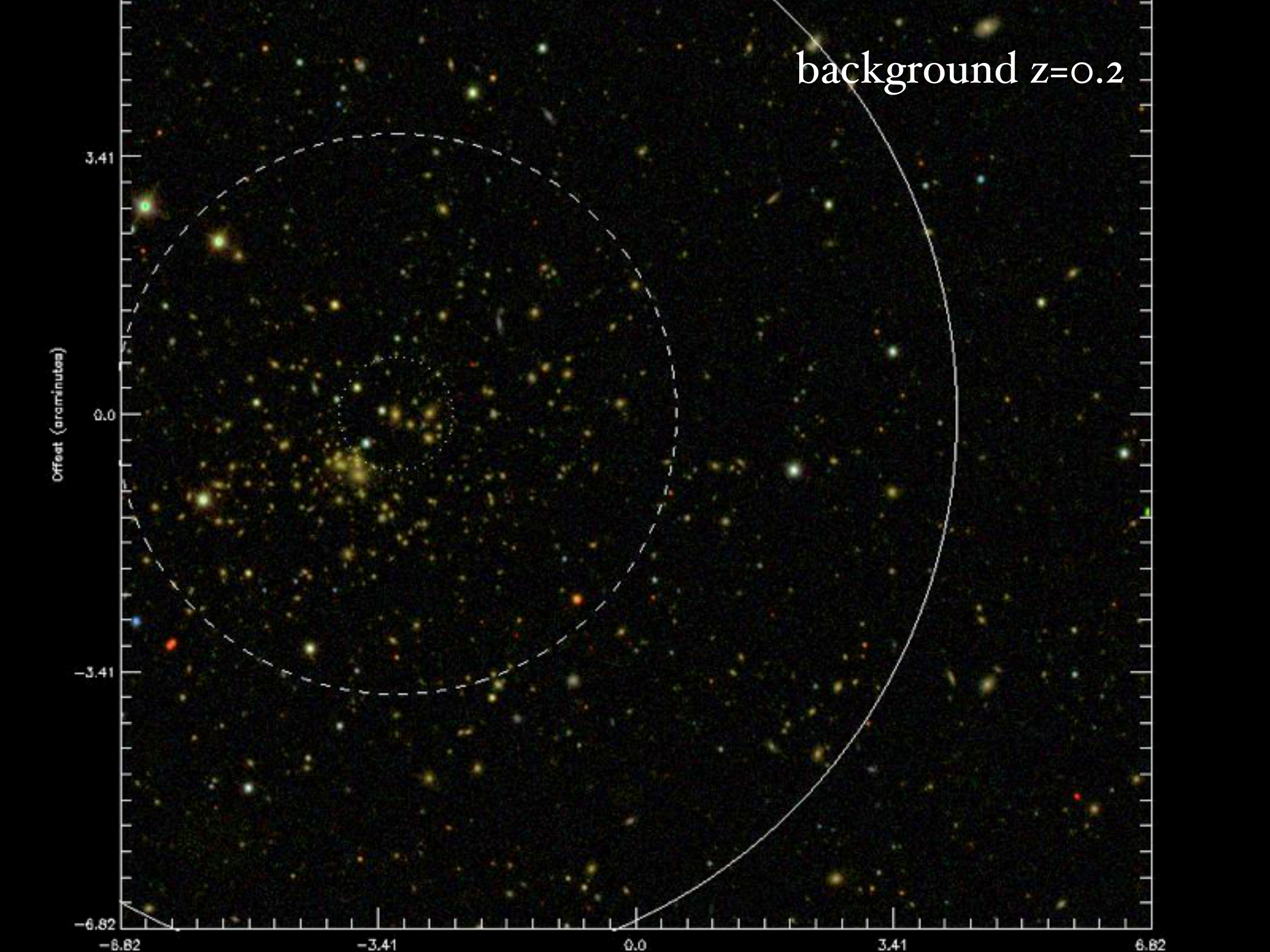

E
W

Average Profile

- Can measure mean halo mass distribution on small radius.
- Neighboring objects dominate at large radius.




Abell 1689 z=0.18
3.41
0.0
−3.41
Offset (arcminutes)


background z=0.2
3.41
0.0
−3.41
−6.82
−6.82
−3.41
0.0
3.41
6.82
Offset (arcminutes)

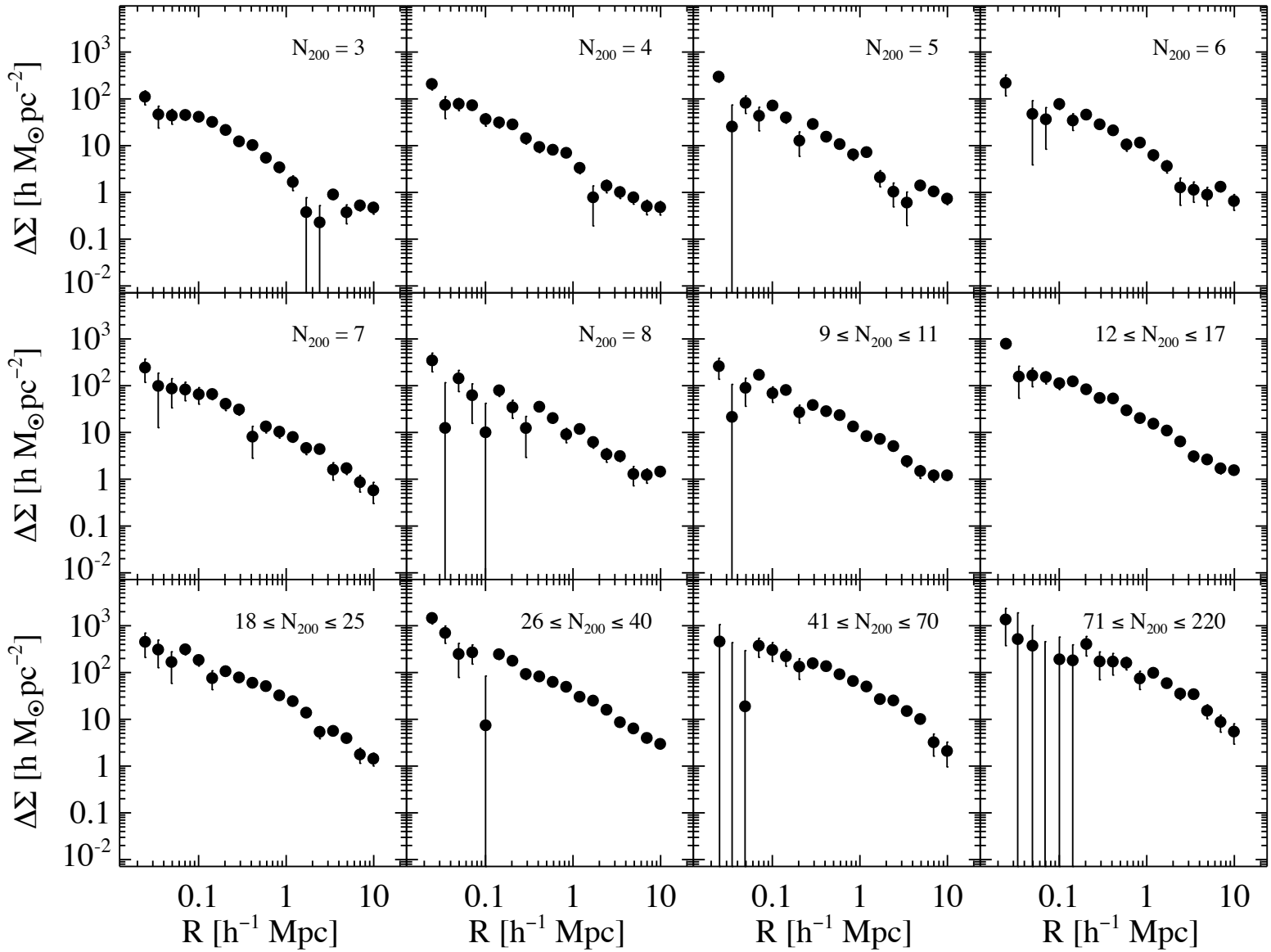
MaxBCG Cluster catalog

Koester, et al. 2006

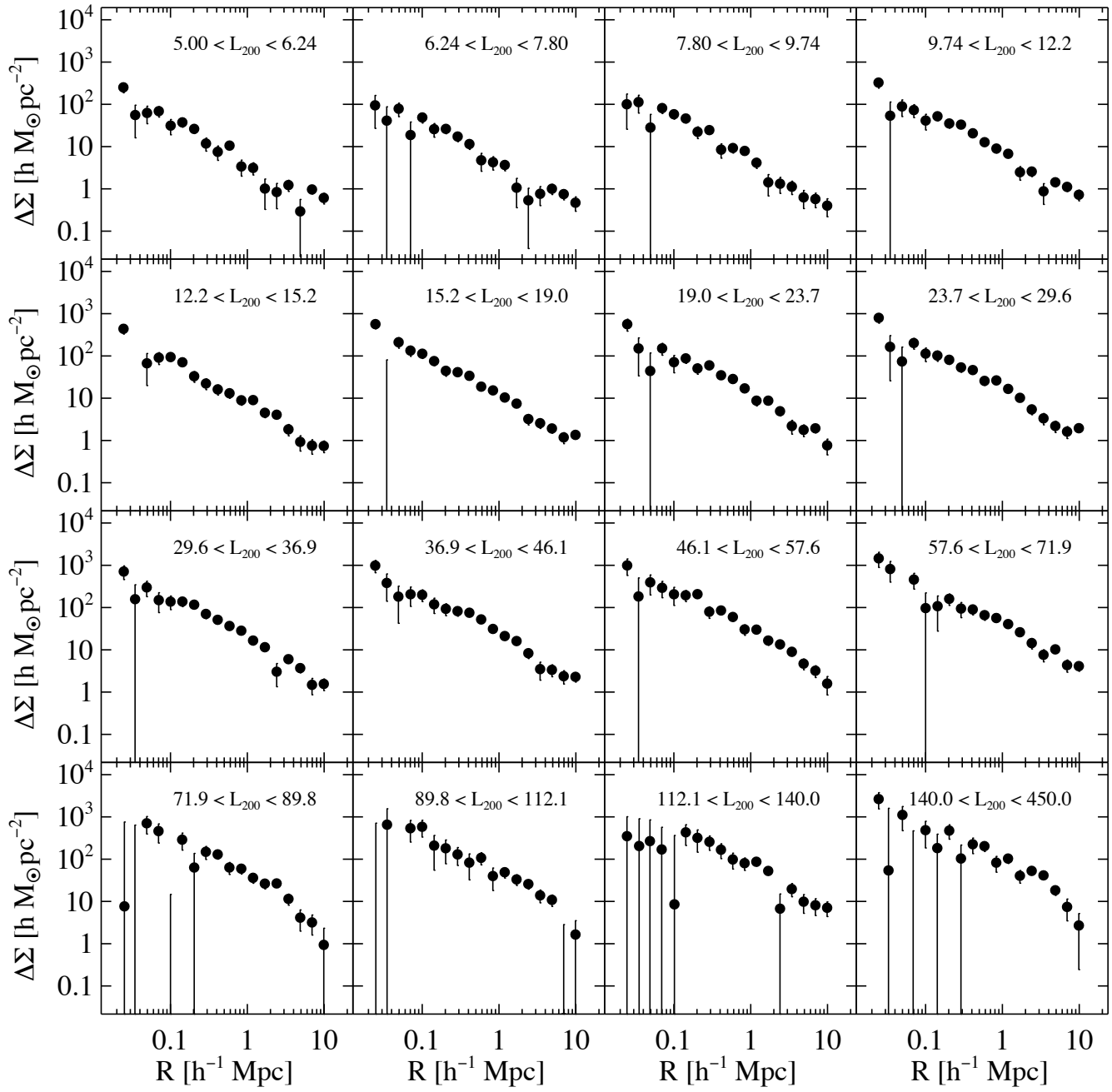
- Look for overdensities of red galaxies
- Keep track of number of member galaxies, total luminosity.
- "Max"-imum likelihood approach. Use likelihood of being a cluster and richness to define sample top-down.
- "BCG" an important part of likelihood. Also used as cluster center.

$120,000$ with $L_i > 5 \times 10^{10} L_\odot$

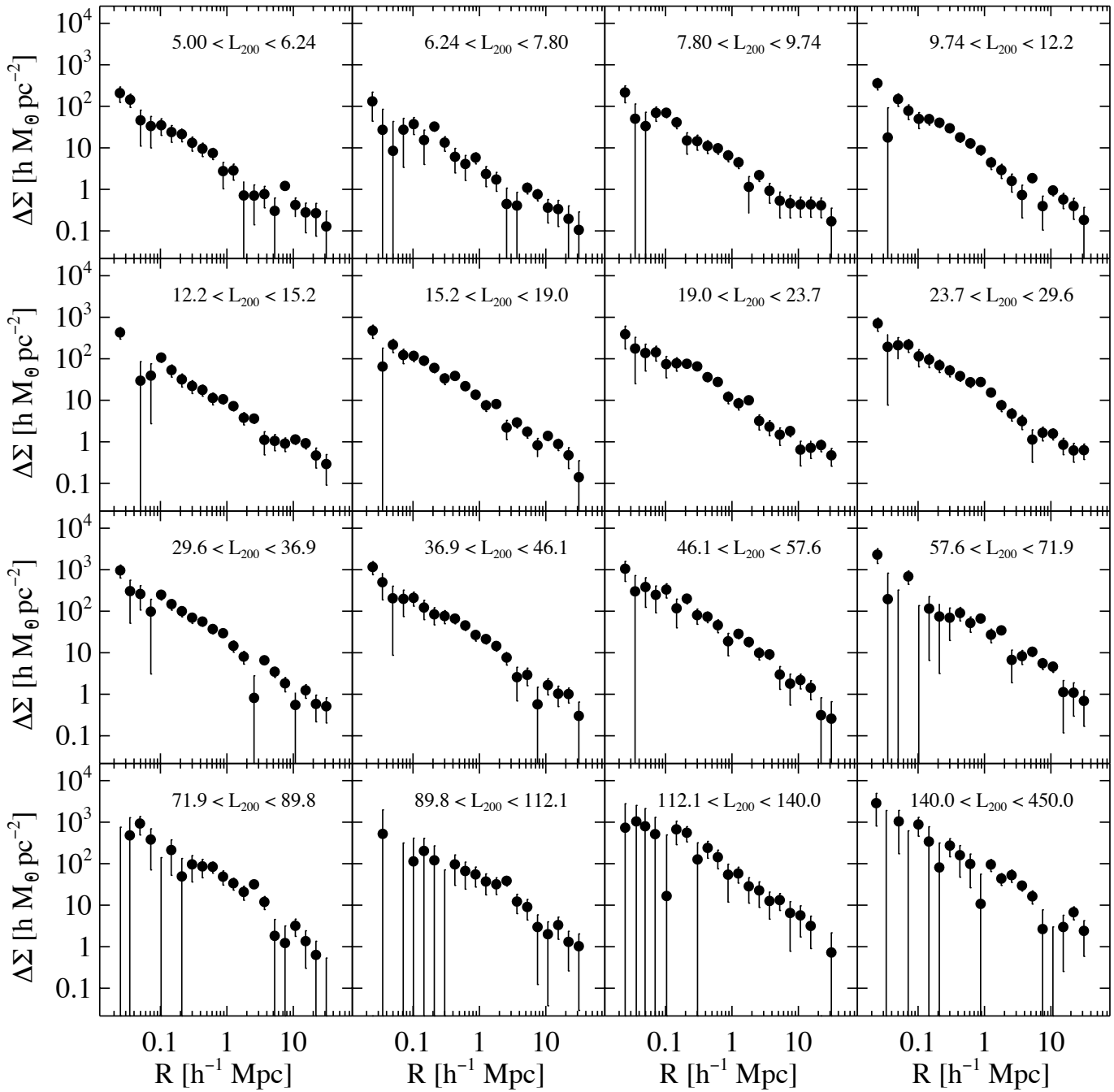
Lensing Measurements to 10 Mpc Binned by Ngals



Binned by Luminosity



Binned by Luminosity: 30 Mpc

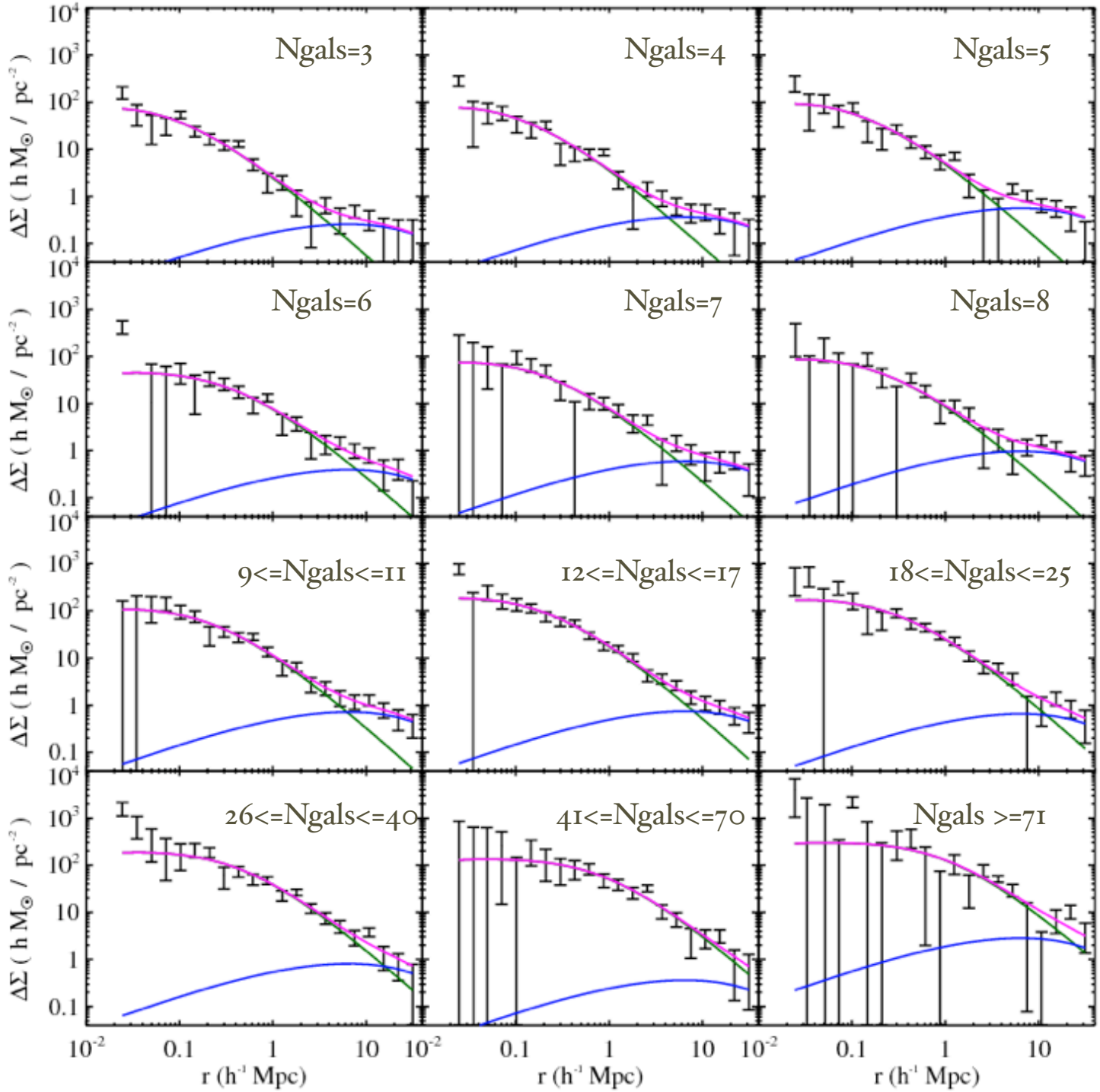


Fit Profile: NFW and Bias

NFW

Bias

Total



Add a point mass

NFW

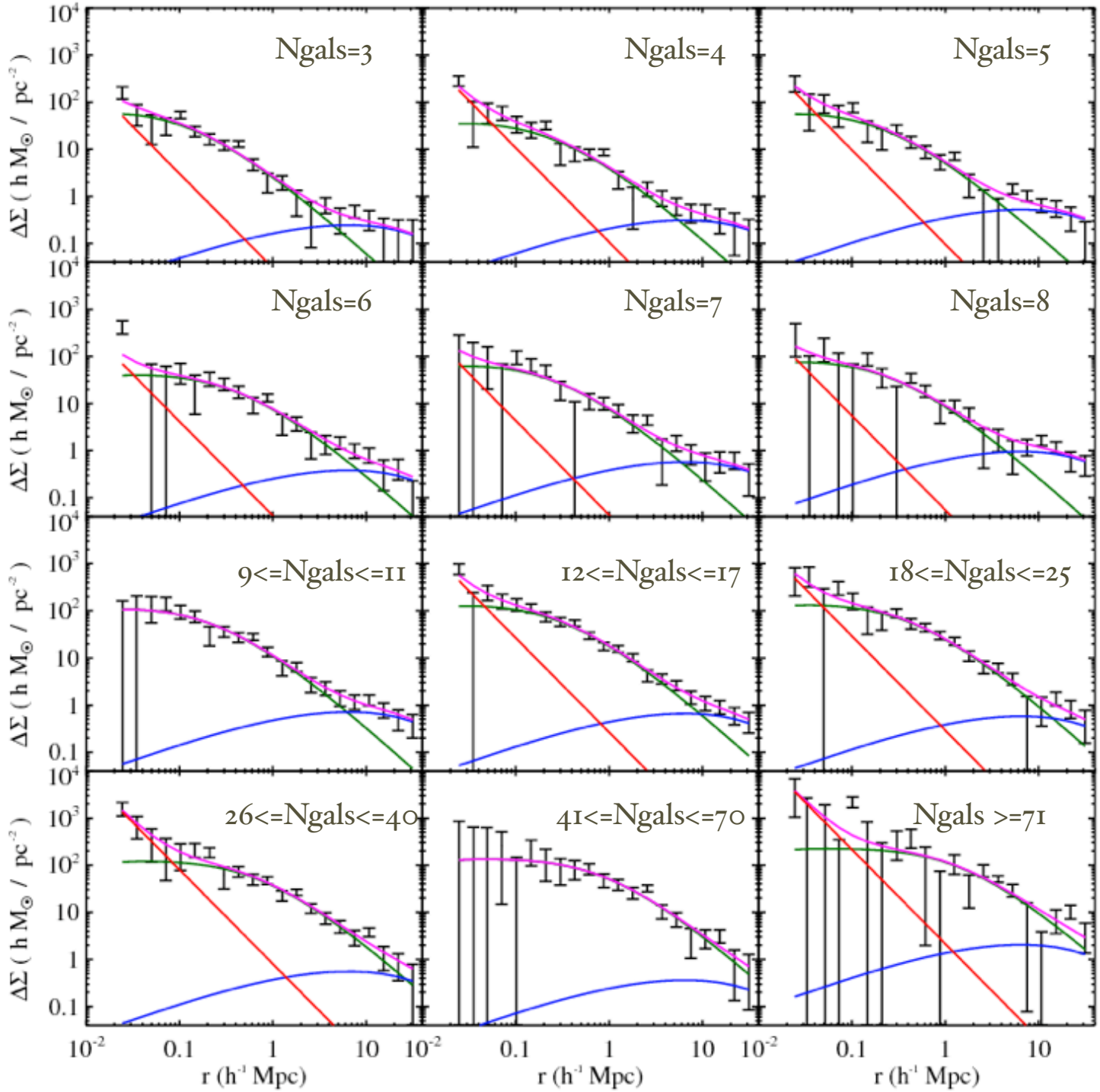
Bias

Point Mass

Total

Point masses

$10^{11} - 10^{12} M_{\odot}$



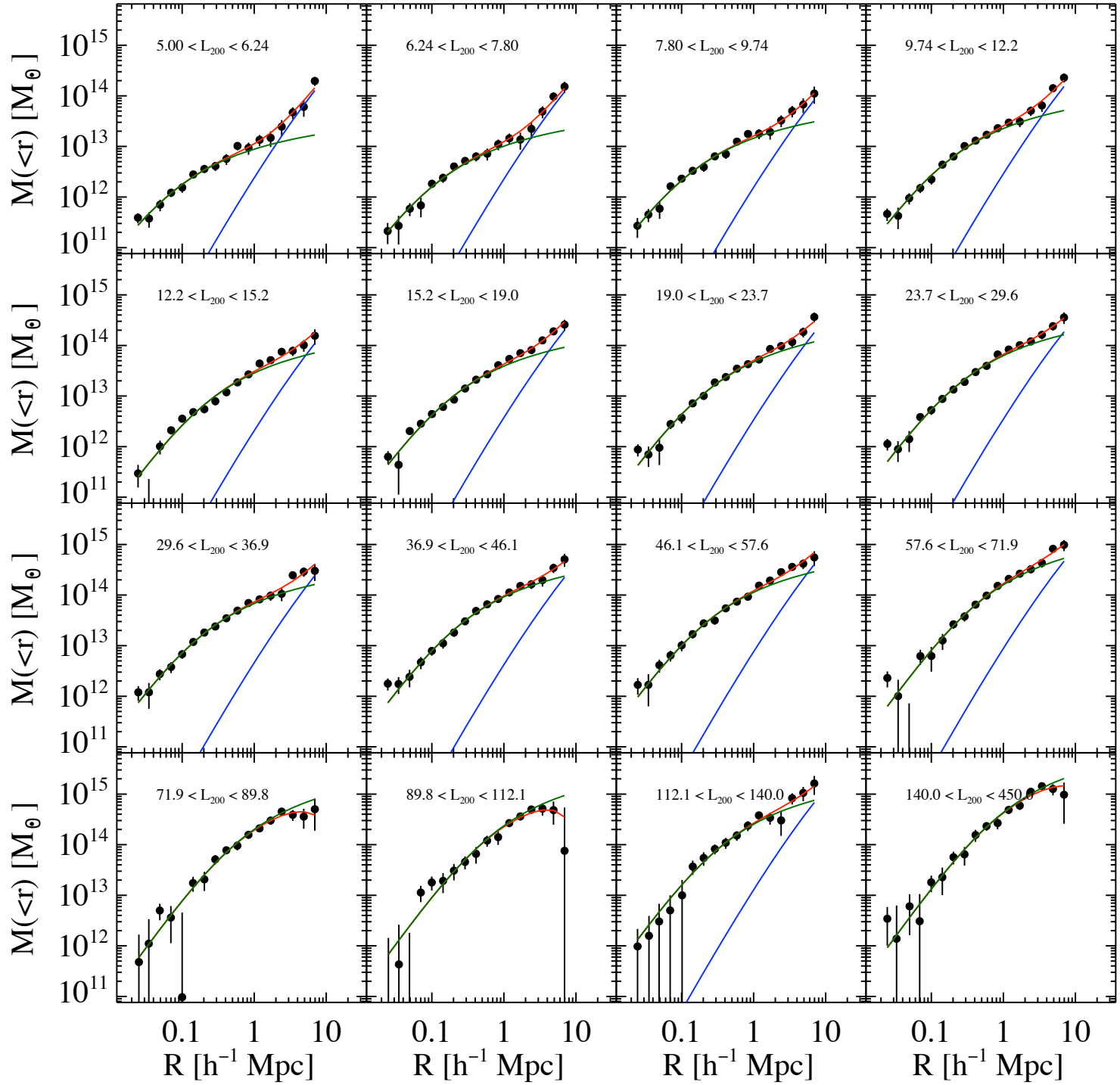
Mass(<r)

Max Radius
10 Mpc

NFW

Bias

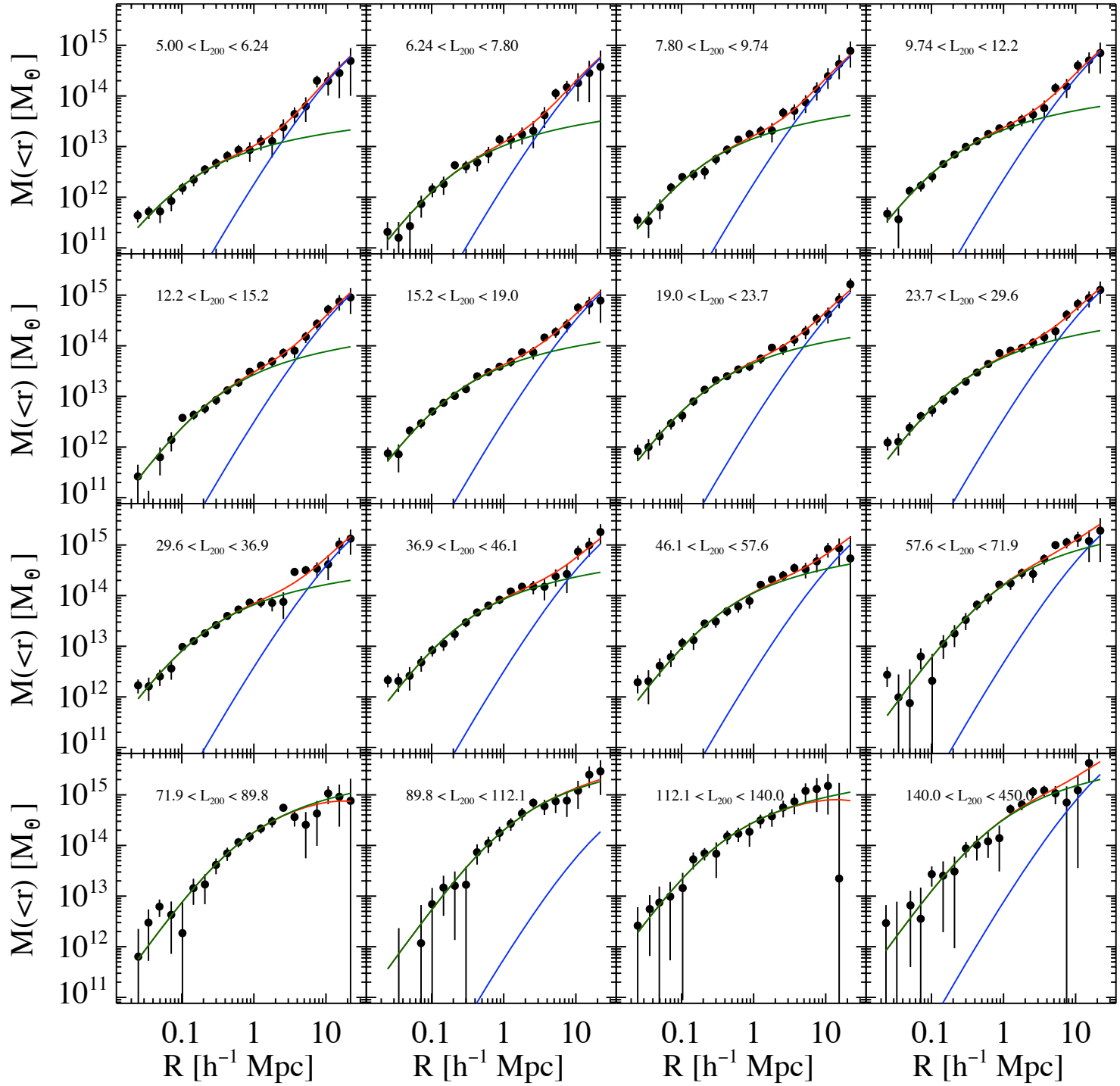
Total



Mass(<r)

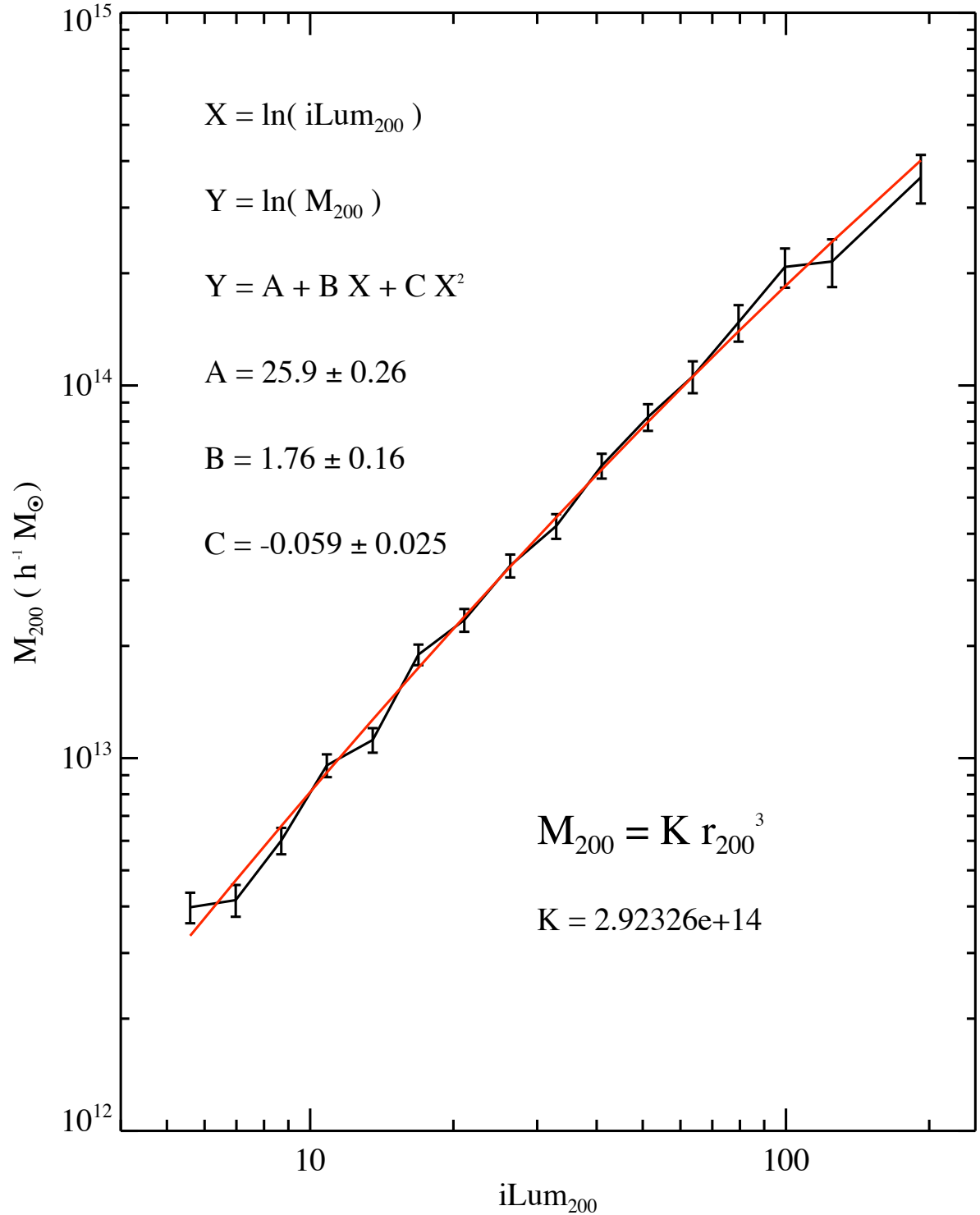
Max Radius
30 Mpc

NFW
Bias
Total



Exit

- M(r200) vs. L(r200) in red galaxies
- Quadratic in logarithmic variables.



DES predictions

- Sensitivity as a function of source photoz, predicted N(z) for clusters and sources.
  - Raw sensitivity is a factor of 5 higher than SDSS. Area is half.
  - Signal generically higher: lenses at higher redshift
  - S/N for a given richness is a strong function of cosmology due to cluster counts.
  - Source N(z)